Cool4M Programmers Reference Manual (PRM)

Cool
Automation

Cool4M
MODBUS
RS232 ASCII
Bridge

Cool4M

Table of Contents
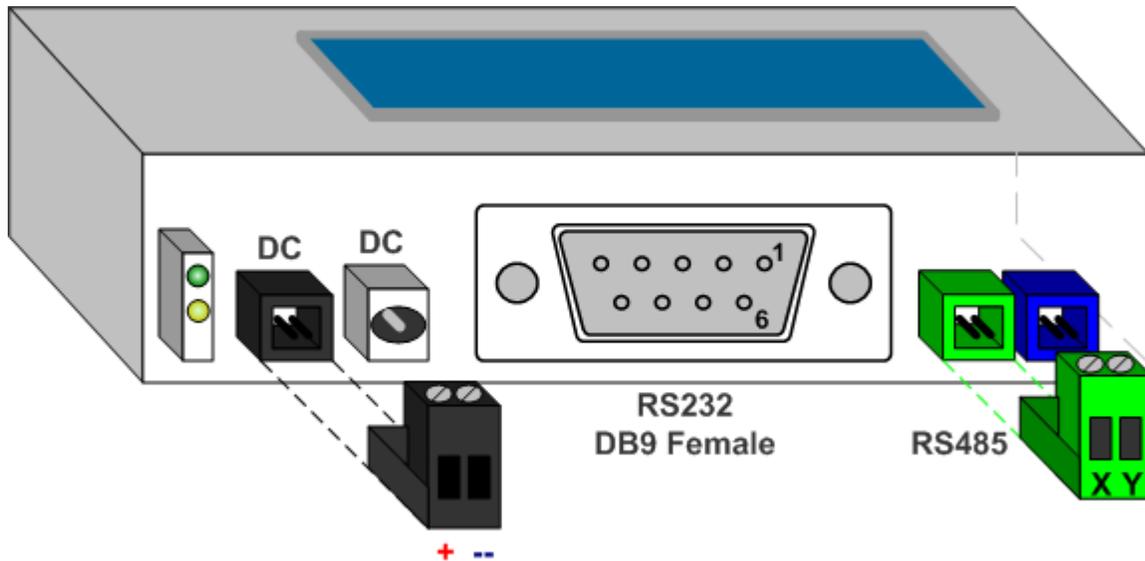
1   Revisions History

Document revision 0.1 Thursday, December 06, 2012

- 0.1 Initial

PRELIMINARY

2   Cool4M Layout

2.1   RS232 Connection

RS232 Interface connector used in Cool4M is D-Type 9-pin DB9 female connector.

DB9 Pin	Signal Lvel	Description
2	±12V	TxD (Data from Cool4M)
3	±12V	RxD (Data to Cool4M)
5	GND	Ground

According to RS232 specification cable length should not exceed 25m. RS232 Cable supplied with Cool4M is 1.5m length, it is suitable for direct connection to PC RS232 serial port.

To communicate Cool4M from PC, PC RS232 Port should be configured with the following parameters

Baud Rate	9600
Data Bits	8
Parity Control	None
Stop Bits	1
Flow Control	None

Below is an example of COM1 port setup in HyperTerminal application

PRELIMINARY

COM1 Properties

Port Settings

Bits per second: 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

Restore Defaults

OK   Cancel   Apply
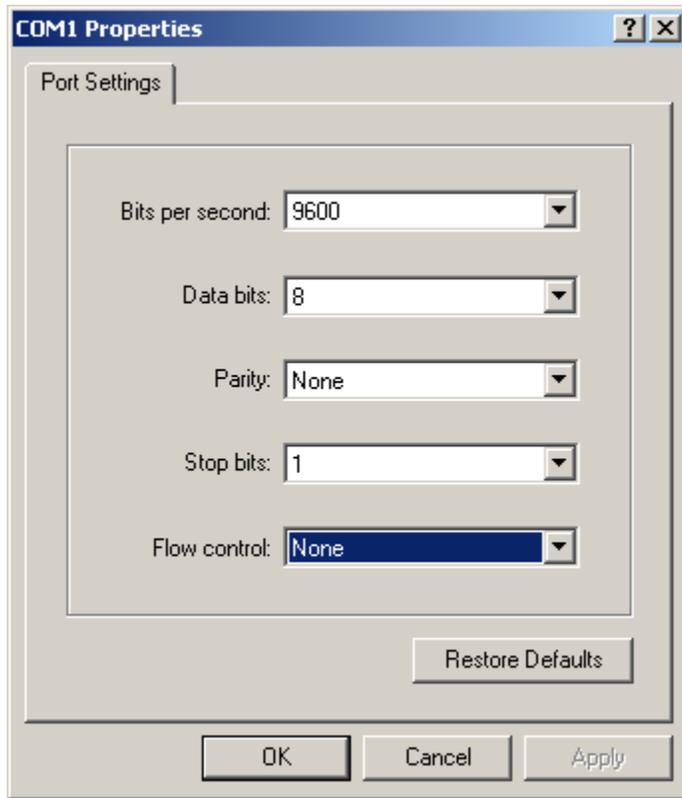
The 9600 Baud Rate is a factory default. It can be changed with set command **B2** parameter.

2.2 RS485 Connection

The X and Y terminals of the **green** connector (see Cool4M Layout) are RS485 signal lines. Cool4M provides a "Two-Wire" electrical interface described in Modbus-IDA.ORG document ("MODBUS over serial line specification and implementation guide"). The Cool4M RS485 interface is fully compliant with EIA/TIA-485 standard.
Cool4M has a configurable X,Y terminals polarity defined with set command **polarity** parameter that can be "AB" or "BA".

EIA/TIA-485 Name	Alternative Names	polarity = AB	polarity = BA
A	D0, +	X	Y
B	D1, -	Y	X

RS485 default frame format is

Baud Rate	9600
Data Bits	8
Parity Control	None
Stop Bits	1
Flow Control	None

RS485 Baud Rate can be changed with set command **B4** parameter. Parity is defined by **P4** parameter value.
Additionally, according to MODBUS guide, the COMMON (GND) signal must also interconnect all the devices of the RS485 bus.
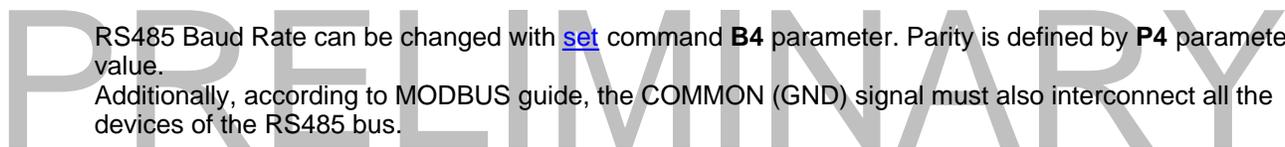
3 General Protocol Definitions

3.1 Message format

Communication between PC or Home Automation Controller and Cool4M via RS232 interface is based on text messages. Communication example is shown below

```
>crd 050 100          ←command    PC to Cool4M
050 00100:0           ←response
OK                    ←exit code   Cool4M to PC
>                     ←prompt
```

Command message sent to Cool4M must be terminated by CR (carriage return 0x0D) LF (line feed 0x0A) sequence or a single CR character. Messages from Cool4M (except prompt character) are always terminated by CR LF. Commands are case sensitive and should not contain leading or trailing spaces. The only separator between command name and command parameter(s) is space character. **Echo** configuration parameter (see set command), defines if characters sent to Cool4M are echoed back or not. If **echo** not zero characters are echoed.

In case of wrong command Cool4M will return :

```
ERROR:79
>
```

Detailed information about commands and responses is provided in Cool4M Commands chapter.

3.2 Command Parameters

* Coding style
Parameters listed in Cool4M command and response definitions are denoted as

ABC

Where ABC is parameter abbreviation listed in parameters table below.

* Brackets around parameters
Parameters or parameters group in angle brackets **< >** are mandatory. Parameters or parameters group in square brackets **[ ]** are optional and can be omitted. The **|** character between parameters inside brackets means OR.

* Parameters format
Parameters sent to Cool4M as command parameters are limited only by parameter's range while response parameters have a predefined and fixed length in characters. It is done to simplify response parsing as in this case parameter's position in response string is constant. Fixed length is achieved by padding values with leading zero(s) or space(s).

* Unsigned/Signed Decimal and Hexadecimal presentation
Parameters can be represented and treated as unsigned or signed decimal or hexadecimal numbers. Hexadecimal numbers are always anticipated with **0x** prefix. Negative signed decimal numbers are anticipated with minus character. Cool4M automatically detects presentation of input parameters. Output parameters are by default unsigned decimal numbers. To change output parameters presentation to signed decimal or hexadecimal use S or H modifier with accordance to specific

command synopsis.

- Parameters List

Below is the list of parameters used in Cool4M commands and responses.

Abbreviation	Description	Presen tation	Range		Format in Response
			min	max	
MA	MODBUS Device Address.	Dec	0	255	000 .. 255
		Hex	0x00	0xFF	0x00 .. 0xFF
SA	Start Address	Dec	1	65535	00001 .. 65535
		Hex	1	0xFFFF	0x0001 .. 0xFFFF
CNT	Counter		1	2000	
WCNT	Coils Write Counter		1	1968	
RDCNT	Registers Read Counter		1	125	
WRCNT	Registers Write Counter		1	123	
BIT	On/OFF status		0	1	0 .. 1
VAL	Value	Dec	0	65535	00000 .. 65535
		Signed	-32767	32767	-32767 .. 32767
		Hex	0x0000	0xFFFF	0x0000 .. 0xFFFF

PRELIMINARY

4   Cool4M Commands

Commands List

crd - Read Coils
drd - Read Discrete Inputs
hrd - Read Holding Registers
ird - Read Input Registers
cwr - Write Coils
hwr - Write Holding Registers
set - Cool4M Configuration
scan - Look for slave devices
row - Row message
tty - TTY mode

Error Codes

OK   Successfully Executed
ERROR:01   Illegal function
ERROR:02   Illegal data address
ERROR:03   Illegal data value
ERROR:04   Slave Device failure
ERROR:05   CRC Error
ERROR:10   Timeout
ERROR:80..99 Wrong Parameters

4.1   hrd - Read Holding Registers

SYNOPSIS

> **hrd [S|H] <MA> <SA> [<RDCNT>]**

DESCRIPTION

MODBUS Function: 0x03 - Read Holding Registers.

Read **RDCNT** contiguous holding register(s) from MODBUS slave device **MA** starting at register **SA**. If **RDCNT** omitted it is is assumed to be 1. With **S** modifier response value(s) will be treated as signed, with **H** modifier as hexadecimal

RESPONSE

> **<MA> <SA>:<VAL> [<SAn>:<VALn> ...]**

EXAMPLE

PRELIMINARY

```
>hrd 50 1
050 00100:001234
OK
>hrd 51 200 2
051 00200:060000 00201:00001
OK
>hrd S 52 1 2
052 00001:12000 00002:-00500
OK
>hrd H 0x34 1 2
0x34 0x0001:0x2EE0 0x0002:0xFE0C
OK
```

EXIT CODE

OK   Successfully Executed
ERROR:XX   See Error Codes

4.2   hwr - Write Holding Registers

SYNOPSIS

> hwr <MA> <SA> <VAL>
> hwr <MA> <SA> <VAL1>[<VALn>...]

DESCRIPTION

MODBUS Functions: 0x06 - Write Single Register, 0x10 - Write Multiple Registers.

In first form write holding register **SA** of the MODBUS device **MA** with value **VAL** using MODBUS function 0x06 - Write Single Register. In second form write N subsequent holding registers of the MODBUS device **MA** starting at register **SA**. Register values are defined by sequence **VAL1** .. **VALn**. Operation is performed using MODBUS function 0x10 - Write Multiple Registers.

RESPONSE

No

EXAMPLE

```
>hwr 0x10 0x200 1200
OK
>hwr 0x10 0x300 0x40 0x41 0x50
OK
```

EXIT CODE

OK   Successfully Executed
ERROR:XX   See Error Codes

4.3   set - Cool4M Configuration

SYNOPSIS

> set [PARM PARAM_VAL]

DESCRIPTION

PRELIMINARY

- Without parameters set command dumps current values of all supported parameters
- With **PARAM** and **PARAM_VAL** will change parameter value

Parameters are stored in nonvolatile memory. Below is the list of supported parameters. Read only parameters can not be changed with set command. The bold value is a factory default.

Parameter	R/W	Description	Value Range
B2	R/W	RS232 Baud Rate bps	1200, 2400, 4800, **9600**, 19200, 38400
B4*	R/W	RS485 Baud Rate bps	
P4	R/W	RS485 Parity	**N-no**, E-even, O-odd
polarity*	R/W	RS485 Polarity. (See RS485 Connection)	**AB**, BA
timeout*	R/W	Default MODBUS response timeout in milliseconds	1ms..10.000ms. (Default **200ms**)

Notes:
* - Effective changing of this parameter requires Cool4M power reset.

RESPONSE

- Without parameters:
  > **<PARAM1><PARAM_VAL1>**
  > **<PARAM2><PARAM_VAL2>**

  > **. . .**
- With parameters - no response

EXAMPLE

```
>set B2 9600
OK
```

EXIT CODE

OK   Successfully Executed
ERROR:80..99   Wrong parameter
ERROR:60   Wrong parameter value

4.4   scan - Look for slave devices

SYNOPSIS

> **scan [MA₁ MA₂]**
> **fscan [S|H] <READ_FUNK> <SA> [MA₁ MA₂]**

DESCRIPTION

Scan Looks for MODBUS slave devices connected to Cool4M RS485 bus subsequently sending Read Device Identification request (MODBUS 0x2B function code) to slave devices with addresses in range **MA1**..**MA2** or 1..247 if **MA** parameters are not specified. Read Device Identification request sent by Cool4M contains only request for basic mandatory object id's: Object Name, Product Code and Revision. Slave devices that support this request will provide above information in reply. Devices that do not support 0x2B function will reply with ILLEGAL FUNCTION error code. And finally if there is no slave device with scanned address, request will timeout. Based on the request result scan will print per scanned address one of the following lines :

- MA + NAME CODE REV There is a Slave device at address MA. Slave supports 0x2B function
- MA + There is a Slave device at address MA. Slave does not support 0x2B function
- MA - There is no reply from Slave device at address MA

Fscan will implement ModBus **READ_FUNC** function trying to read from **SA** object. **READ_FUNC** can be:
- 0x01 or 1 - Read Coils
- 0x02 or 2 - Read Discrete Inputs
- 0x03 or 3 - Read Holding Registers
- 0x04 or 4 - Read Input Registers

With **S** modifier response value(s) for functions 3 and 4 will be treated as signed, with **H** modifier as hexadecimal.

Scanning can be externally terminated upon receipt of the SPACE (0x20) character from RS232 port.

RESPONSE

In first form:

MA$_1$ <+ NAME CODE REV>|+|-

...

MA$_n$ <+ NAME CODE REV>|+|-

In second form:

MA$_1$ <+ VAL>|+|-

...

MA$_n$ <+ VAL>|+|-

EXAMPLE

```
>scan 0x10 0x12
0x10 + COOLGATE 1000D 25
0x11 -
0x12 +
OK
>scanf 3 1 0x10 0x12
0x10 + 0x1234
0x11 -
0x12 +
```

EXIT CODE

OK Successfully Executed
ERROR:80..99 Wrong parameter

COMPATIBILITY

Version 0.0.1 Supported only fscan with function 3

4.5 tty - TTY mode

SYNOPSIS

  tty [+]

DESCRIPTION

PRELIMINARY

Switch Cool4M into transparent RS232 to RS485 adapter mode (TTY mode). In TTY mode every byte received by cool4m from RS232 line will be immediately transmitted to RS485 bus. And vice versa bytes received from RS485 will be forwarded to RS232. If '+' character is provided as command parameter the sequence of +++ characters received from RS22 line will terminate TTY mode. Otherwise the only way to exit TTY mode is power reset.

RESPONSE

No

EXIT CODE

No

PRELIMINARY

5   Firmware Update

5.1   Entering bootloader mode

The process of updating Cool4M's firmware is very simple and straightforward. First of all Cool4M has to be switched into bootloader mode. In order to do so, please connect your PC to the RS232 port of the Cool4M, open Hyper Terminal program and run boot command. "BOOT" message should appear on Cool4M LCD. Now Cool4M is ready for firmware download. Please close Hyper Terminal program and follow the next step - Firmware Download.

If for some reason Cool4M is not responding to boot command or preceding firmware update has failed and Cool4M is not functioning at all, perform the steps below in order to force Cool4M to enter bootloader mode.

Step1	Disconnect power supply from Cool4M
Step2	Open Cool4M top cover
Step3	Open BOOT jumper shown on the picture
Step4	Connect power supply to Cool4M
Step5	Close BOOT jumper
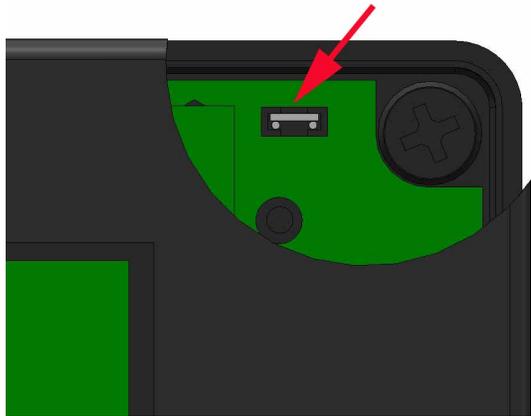
5.2   Firmware Download

Firmware update package is supplied as a set of BAT file(s) and firmware image(s). BAT file can be for example `progp-COOL4M.bat` and corresponding image file `COOL4M.INC`. Make sure that BAT file and the image file are located in same directory. In order to start the process simply run the BAT file.
After running BAT file, the ComPort selection prompt will appear and the correct port number should be entered in order to proceed.
Cool4M will react with running address counter on its LCD screen. The whole process may take a few minutes, and it ends with "EOF" and shortly afterwards "READY" messages on the LCD screen.

5.3   Reboot

After firmware downloading has being finished you need to power reset Cool4M. If it was entered bootloader mode with BOOT jumper, please make sure to close BOOT jumper back before power reset.

PRELIMINARY